Kidney International, Vol. 54 (1998), pp. 1305–1310

American Indian heritage and risk factors for renal injury

BERTRAM L. KASISKE, STEPHEN RITH-NAJARIAN, MICHELE L. CASPER, and JANET B. CROFT

Division of Nephrology, Department of Medicine Hennepin County Medical Center, Minneapolis, and Diabetes Program, Bemidji Area Office, Indian Health Service, Bemidji, Minnesota; and Cardiovascular Health Branch, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

American Indian heritage and risk factors for renal injury.

Background. Little is known about the causes and consequences of renal disease among American Indians in the Great Lakes region of the United States.

Methods. We examined clinical correlates of albumin/creatinine ratios among 1368 participants in the three tribal communities of the Inter-Tribal Heart Project using univariate and multivariate analysis.

Results. Compared to 1086 participants without albuminuria, the 240 with microalbuminuria (30 to 299 mg/g) and the 42 with macroalbuminuria (>300 mg/g) were more likely to report a history of a myocardial infarction (6.4%, 16.0%, and 23.8%, respectively, $P < 0.001$). Similarly, compared to patients without albuminuria, those with microalbuminuria and macroalbuminuria were more likely to report a history of stroke (2.3%, 8.4% and 26.2%, respectively, $P < 0.001$). In a multiple linear regression model, independent correlates of albumin excretion ($P < 0.05$) included: fasting blood sugar, treated diabetes, treated hypertension, higher systolic blood pressure, lower diastolic blood pressure, abnormal electrocardiogram, a history of stroke, the degree of American Indian heritage, and lower household income.

Conclusions. Urinary albumin excretion is associated with cardiovascular disease outcomes and risk factors among American Indians of the Great Lakes region. Both heredity and socioeconomic status appear to play a role in the pathogenesis of renal injury in this population.

The incidence of renal disease has reached epidemic proportions among American Indians in the United States [1]. Although a number of epidemiological surveys have examined risk factors for renal disease among American Indians, most of these have focused on American Indians from the Southwest. Therefore, we examined risk factors for albuminuria among American Indians from the Great Lakes region, who are genetically and culturally distinct from American Indians in the Southwest.

Key words: Great Lakes population, albuminuria, diabetes, hypertension, myocardial infarction, American Indian heritage, socioeconomic status and health, cardiovascular disease, Inter-Tribal Heart Project.

Received for publication December 1, 1997
and in revised form May 10, 1998
Accepted for publication May 10, 1998

METHODS

Population

The Inter-tribal Heart Project (ITHP) was conducted on the Red Lake and White Earth reservations in Minnesota and on the Menominee reservation in Wisconsin [2]. Participants in the ITHP were identified from age-stratified random samples of active users of the tribal/Indian Health Service clinics. All participants were 25 years old or older and underwent an extensive interview, physical examination, and laboratory screening. The interviews and examinations of 1376 participants were conducted between September 1992 and May 1994. Details of the ITHP have been published previously [2]. The ITHP was approved by the three tribal governments, the Indian Health Service, and the Centers for Disease Control and Prevention. Of the 1376 participants, 8 with end-stage renal disease were excluded from this analysis.

Data collected

The variables included in the present analysis were: gender, age, family history (diabetes, hypertension, stroke, heart attacks, or kidney disease), degree of Indian heritage (full, 3/4, 1/2, 1/4, less than 1/4, or unknown), history of hypertension (ever told had high blood pressure), taking antihypertensive medication at the time of interview, history of hypercholesterolemia (ever told), taking lipid-lowering medication, history of diabetes (ever told), taking insulin or an oral hypoglycemic agent, alcohol consumption, ever smoked at least 100 cigarettes during lifetime, currently smoking at the time of interview, household income, whether buying common items such as groceries was difficult, highest grade of school completed, history of myocardial infarction, history of stroke, or treatment for end-stage renal disease (ESRD, dialysis, or transplantation). An electrocardiogram was obtained and for this study was called abnormal if there was evidence of acute ischemia, rhythm disturbance, or QT prolongation. Variables from the physical examination that were used in this study were height (cm), body weight (kg), waist (cm), hip circumference (cm), waist-to-hip ratio, body mass index = (body weight in kg)/(height in m)^2/seated systolic and diastolic

blood pressure mm Hg (average of second and third measurements from three consecutive readings). Mean arterial pressure was calculated as 1/3 (systolic − diastolic) + diastolic.

Fasting serum laboratory values included: glucose, insulin, serum creatinine, total cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), apolipoprotein A1, apolipoprotein B, and lipoprotein (a). A spot urine sample for creatinine and albumin was used to calculate the albumin/creatinine ratio (ACR). Albumin was measured on a spot urine sample using nephelometry; and creatinine was measured using the alkaline picrate method. Glomerular filtration rate was estimated from serum creatinine using the Cockcroft-Gault formula [3]. The data for triglycerides and ACR were not normally distributed and were transformed using the natural logarithm for statistical analysis.

Analysis

Differences in parametric variables were compared with one-way analysis of variance and Duncan's multiple-range comparison test. Differences in categorical variables were tested using chi-square. Stepwise multiple linear regression analysis was also carried out with multiple independent variables and the natural logarithm of the ACR as the dependent variable. For the multiple linear regression analysis, missing values were imputed according to the method of Rubin and Schenker [4]. Briefly, five separate data sets were created with five different random imputations of missing data. The regression analysis was carried out using each of the five imputed data sets, and the 95% confidence intervals were calculated by combining the "within imputation" and the "between imputation" standard errors [4]. Data are presented as means ± SD or 95% confidence intervals unless otherwise indicted. Data were analyzed using the Statistical Package for the Social Sciences [5].

RESULTS

Population characteristics

Participants were 47.7 ± 14.1 (range 24.8 to 92.3) years old, 37.0% were men, and 68% reported at least 50% American Indian heritage (Table 1). Cardiovascular disease and risk factors for cardiovascular disease were common: 8.7% had a history of myocardial infarction, 4.1% had a history of stoke, 32.1% had been told they had hypertension (57.5% of these were being treated for hypertension at the time of interview), and 20.1% had been told they had diabetes (of whom 76.2% had been treated with insulin and 79.5% had received an oral hypoglycemic agent). In addition, 85.4% said they had ever smoked at least 100 cigarettes during their lifetime, 64.5% were smoking at the time of interview, 26.5% had been told they had high cholesterol, and 14.3% of these individuals were being treated with a lipid-lowering medication. There were 1.5% who had had an amputation. Of the 1368 participants without ESRD, 240 (17.8%) had microalbuminuria (ACR = 30 to 299 mg/g,), 34 (2.5%) had macroalbuminuria (ACR = 300 to 2999 mg/g), and 8 (0.6%) had nephrotic-range proteinuria (ACR ≥ 2999 mg/g).

Table 1. Proportion of study population with microalbuminuria and macroalbuminuria within each category of self-reported American Indian heritage

American Indian heritage	Total population *N*(%)	Microalbuminuria *N*(%)	Macroalbuminuria *N*(%)
Full	231 (16.9)	57 (23.8)	13 (31.0)
¾	366 (26.7)	66 (27.5)	15 (35.7)
½	328 (24.0)	59 (24.6)	7 (16.7)
¼	227 (16.6)	30 (12.5)	4 (9.5)
<¼	139 (10.2)	14 (5.8)	0 (0.0)
Unknown	77 (5.6)	14 (5.8)	3 (7.1)
Total	1368 (100)	240 (100)	42 (100)

Clinical correlates of albuminuria

In the univariate analysis a number of physiologic factors were associated with both microalbuminuria and macroalbuminuria. These included: older age, increased body weight, increased waist-to-hip ratio, elevated blood pressure, higher serum creatinine, and lower GFR (Table 2). Microalbuminuria and macroalbuminuria were also associated with elevated levels of fasting triglycerides, apolipoprotein B, fasting glucose, and fasting insulin (Table 3). Other correlates of albuminuria included: having at least 50% American Indian heritage, a history of diabetes, lower household income, and less educational training (Table 4). There was a trend for a history of current cigarette smoking to be associated with albuminuria, but this was not statistically significant (Table 4). A history of myocardial infarction, ECG abnormalities, and a history of stroke were each associated with microalbuminuria and macroalbuminuria (Table 5).

Stepwise multiple linear regression was used to determine which variables were most closely associated with albuminuria, and which were statistically independent of other correlates. Separate analyses were carried out for all participants who did not have ESRD ($N = 1368$), and for patients who had an ACR less than 300 mg/g ($N = 1326$). Results were similar whether or not patients with macroalbuminuria ($N = 42$) were excluded (Table 6). Independent variables included fasting blood sugar, a history of diabetes, systolic blood pressure, diastolic blood pressure, a history of treated hypertension, ECG abnormalities, a history of stroke, the percent American Indian heritage, and income level (Table 6). None of the other variables had any independent association with albuminuria once these were taken into account.

Table 2. Relationship of albuminuria with age, weight, blood pressure, and renal function

Variable	Normal ($N = 1086$)	Microalbuminuria ($N = 240$)	Macroalbuminuria ($N = 42$)
Age *years*	46 ± 13[a]	53 ± 15[b]	60 ± 12[c]
Body weight *kg*	83 ± 17[a]	85 ± 19[b]	85 ± 22[ab]
Body mass index kg/m^2	29.9 ± 5.9[a]	31.2 ± 6.0[b]	30.9 ± 7.6[ab]
Waist-to-hip ratio	0.93 ± 0.08[a]	0.95 ± 0.08[b]	1.00 ± 0.10[c]
Systolic blood pressure *mm Hg*	123 ± 16[a]	131 ± 23[b]	144 ± 22[c]
Diastolic blood pressure *mm Hg*	75 ± 10[a]	77 ± 11[b]	78 ± 16[ab]
Mean arterial pressure *mm Hg*	91 ± 11[b]	95 ± 13[b]	100 ± 15[c]
Serum creatinine *mg/dl*	1.00 ± 0.24[a]	1.05 ± 0.37[b]	1.33 ± 0.08[c]
Estimated GFR *ml/min*	100 ± 31[a]	96 ± 37[a]	80 ± 38[b]

[a,b,c] Within each row, values that share a letter (superscript a, b, or c) are not significantly different at $P > 0.05$ by analysis of variance. Conversely, values that do not share a letter are significantly different.

Table 3. Relationship of albuminuria with fasting lipids, glucose, and insulin

Variable	Normal ($N = 1086$)	Microalbuminuria ($N = 240$)	Macroalbuminuria ($N = 42$)
Cholesterol *mg/dl*	210 ± 40[a]	215 ± 42[a]	221 ± 44[a]
LDL cholesterol *mg/dl*	127 ± 36[a]	130 ± 36[a]	129 ± 41[a]
HDL cholesterol *mg/dl*	50 ± 14[a]	48 ± 13[a]	50 ± 24[a]
Triglycerides *mg/dl*	163 ± 111[a]	193 ± 136[b]	208 ± 121[b]
Apolipoprotein A1 *mg/dl*	148 ± 26[a]	148 ± 26[a]	151 ± 26[a]
Apolipoprotein B *mg/dl*	126 ± 30[a]	133 ± 3[b]	135 ± 36[ab]
Fasting glucose *mg/dl*	113 ± 41[a]	157 ± 80[b]	197 ± 80[c]
Fasting insulin *mIU/ml*	15 ± 24[a]	23 ± 35[b]	65 ± 157[c]

[a,b,c] Within each row, values that share a letter (superscript a, b, or c) are not significantly different at $P > 0.05$ by analysis of variance. Conversely, values that do not share a letter are significantly different.

Table 4. Relationship between albuminuria and selected characteristics

Characteristic	Normal ($N = 1086$)	Microalbuminuria ($N = 240$)	Macroalbuminuria ($N = 42$)	*P* value[a]
American Indian heritage ≥ 50%	44.0%	54.0%	72.0%	<0.001
Male	36.5%	36.7%	50.0%	0.206
Diabetic	13.0%	45.0%	73.2%	<0.001
Currently smoking	65.7%	61.9%	50.0%	0.099
Ever smoked	85.9%	81.9%	92.7%	0.113
Household income < $10,000	28.0%	41.0%	59.4%	<0.001
Education < 12 years	26.0%	45.0%	46.3%	<0.001

[a] By chi-square

Table 5. Relationship between albuminuria and end organ damage

Variable	Normal ($N = 1086$)	Microalbuminuria ($N = 240$)	Macroalbuminuria ($N = 42$)	*P* value[a]
Myocardial infarction history	6.4%	16.0%	23.8%	<0.001
Abnormal ECG	7.1%	16.2%	23.8%	<0.001
History of stroke	2.3%	8.4%	26.2%	<0.001

[a] By chi-square

DISCUSSION

We used data from the ITHP to examine clinical correlates of albuminuria. There are two major limitations to this approach. First, clinical correlations can only suggest, but cannot prove, cause-and-effect relationships. Thus, these results cannot establish whether the variables described in this study cause renal injury, result from renal injury, or are related to renal injury because they share common causes. The clinical associations described in this study should only be used to suggest possible mechanisms of renal injury and avenues of future study. The second major limitation of these data are our inability to discern the cause of the renal injury reflected by albuminuria. Although data from other studies suggest that most renal disease in American Indians is caused by diabetic nephropathy [6–9], the incidence of renal disease from other causes may also be increased

Table 6. Independent correlates to albumin excretion

Variable	All Non-ESRD patients ($N = 1368$)		Only patients with ACR < 300 mg/g ($N = 1326$)	
	Coefficient	95% CI	Coefficient	95% CI
FBS *each 10 mg/dl*	0.071	0.052, 0.089	0.059	0.041, 0.077
Treated diabetes (*y/n*)	0.378	0.090, 0.666	0.268	*−0.005, 0.541*
Systolic BP (*each 10 mm Hg*)	0.158	0.103, 0.213	0.110	0.057, 0.164
Diastolic BP (*each 10 mm Hg*)	−0.105	−0.196, −0.013	−0.075	*−0.163, 0.013*
Treated hypertension (*y/n*)	0.276	0.040, 0.511	0.249	0.023, −0.475
Abnormal ECG (*y/n*)	0.371	0.120, 0.622	0.315	0.068, 0.562
Stroke history (*y/n*)	0.571	0.171, 0.971	0.218	*−0.195, 0.632*
American Indian heritage (0.00–1.00)	0.356	0.070, 0.641	0.257	*−0.020, 0.534*
Income level (scale 1 to 7)	−0.066	−0.108, −0.023	−0.063	−0.101, −0.024
Constant	0.227	*−0.480, 0.934*	0.722	0.031, 1.413

Multiple linear regression coefficients and 95% confidence intervals for independent correlates of the natural logarithm of the urine albumin/creatinine ratio. Failure of the CI to exclude zero (in italics) indicates $P > 0.05$. Abbreviations are: FBS, fasting blood sugar; BP, blood pressure; ECG electrocardiogram. See Table 1 defining American Indian heritage. Income level was: 1 = <$5000, 2 = $5–10,000, 3 = $10–$15,000, 4 = $15–20,000, 5 = $20–25,000, 6 = $25–$30,000, 7 = >$30,000.

[10–12]. In addition, causes of renal disease among American Indians from different regions may be different, and there are few epidemiological studies of American Indians from the Great Lakes region in the United States.

The many correlations between albuminuria and cardiovascular disease risk factors suggest that albuminuria is a sensitive marker of vascular injury and that causes of microvascular disease in the kidney may be similar to causes of vascular injury in other organs. Indeed, many of the features of the so-called metabolic syndrome were evident in the ITHP, including obesity, increased waist-to-hip ratio, hyperinsulinemia, hypertension, and hypertriglyceridemia. All of these metabolic risk factors were also associated with microalbuminuria and/or macroalbuminuria in the univariate analysis. The association between the metabolic syndrome and microalbuminuria has been reported in other populations as well [13, 14]. In addition, albuminuria and proteinuria have been reported to be associated with cardiovascular disease in the general population [15, 16]. Whether these associations result from the metabolic profile causing renal injury, whether renal injury causes or exacerbates features of the metabolic profile, or whether other factors cause both the metabolic abnormalities and renal injury is unclear.

It should be no surprise that diabetes was an independent correlate for albuminuria. Indeed, diabetes is the leading cause of ESRD in the United States [1], and in other American Indian populations diabetes has been reported to be the most common cause of renal disease [7, 9]. It was also interesting to note that, independent of whether or not patients had a history of diabetes, fasting glucose levels were correlated with albuminuria. This is consistent with the observation among people with Type 1 diabetes that the degree of blood sugar control is an important determinant of albuminuria in patients with diabetes [17].

Hypertension also correlated independently with albuminuria, and in addition, systolic blood pressure was independently linked to albuminuria. These data are consistent with the notion that both hypertension and the degree of blood pressure control are important determinants of renal injury. There is an abundance of data from other studies that hypertension and its control are important in the pathogenesis of renal injury. Indeed, hypertension was recently shown to be an independent risk factor for ESRD in a cohort of 332,544 men screened for the Multiple Risk Factor Intervention Trial [18]. In addition to modulating renal injury from other causes such as diabetes, hypertension has been shown in at least some populations to itself cause nephrosclerosis [19]. Interestingly, once hypertension and systolic blood pressure were taken into account in the present study, lower diastolic pressure was associated with albuminuria. A relative reduction in diastolic pressure and/or a widened pulse pressure may be associated with atherosclerotic vascular disease, which, in turn, may be linked to albuminuria.

Both ECG abnormalities and a history of stroke were independent correlates of albuminuria, and both are indicative of a more general association between cardiovascular disease and albuminuria. It has previously been reported that otherwise normal individuals with coronary artery disease have more evidence of renal injury than individuals without coronary artery disease [20]. It is likely that one or more factors involved in the pathogenesis of cardiovascular disease may also cause renal injury. In addition to diabetes and hypertension, there are some experimental data suggesting that hyperlipidemia may cause renal injury [21, 22]. Indeed, lipid abnormalities were associated with albuminuria in the univariate but not in the multivariate analysis, possibly because cardiovascular disease *per se* was more closely correlated with renal injury.

This study suggests that socioeconomic factors may be linked to renal injury. Family income was independently associated with increased urine albumin. Education was

also associated with albuminuria in univariate analysis but was not independent of income level and other variables in the multivariate analysis. Indeed, there was a correlation between household income and the number of years of formal education. Socioeconomic status is known to be an important determinant of health status [23, 24] and may be related to albuminuria via access to care, diet, living conditions, physical activity, and other factors.

An important finding in the present study was the strong association between the degree of self-reported American Indian heritage and renal injury. This association was statistically independent of both metabolic and socioeconomic risk factors. Similar findings were reported in the Strong Heart Study [25]. The Strong Heart Study examined clinical correlates to ACR among American Indians from Arizona, Oklahoma, South Dakota, and North Dakota, and found that fasting glucose, insulin, systolic blood pressure, age, male gender, fibrinogen, and waist-to-hip ratio were independent correlates to albuminuria. Despite the fact that the participants in the Strong Heart Study were from tribes that are distinct from those of the participants in the present investigation, the degree of American Indian heritage was also an independent risk factor for albuminuria. Pettitt et al have also reported a familial predisposition proteinuria among Pima Indians with Type 2 diabetes [26].

The association between self-reported American Indian heritage and renal injury should be interpreted cautiously for several reasons. The data on American Indian heritage are based on self-reports and are therefore subject to bias. Furthermore, the data cannot exclude the possibility that the degree of American Indian heritage is associated with renal injury via mechanisms that are related to known risk factors, such as diabetes, hypertension, etc. Indeed, it is likely that the relatively crude clinical measures for these known risk factors may not have fully measured their effects on the kidney in this study, and that the degree of American Indian heritage may have been a surrogate for diabetes, hypertension, and other risk factors. It is also possible that American Indian heritage may have been a surrogate for other environmental factors that are associated with renal injury, but are not accounted for in the study variables. In order to more fully address the pathways through which American Indian heritage may be associated with renal injury, carefully designed studies that examine the gene-environment interaction are needed.

In summary, both diabetes and hypertension were risk factors for renal injury in this study. The fact that the degree of self-reported American Indian heritage was also an independent correlate with albuminuria suggests there may be a genetic component of the susceptibility to renal injury. In addition, the independent association between income level and renal injury suggests that socioeconomic factors also play a role. All of these associations were already evident in participants with microalbuminuria. This analysis suggests that further gene and gene-environment studies may yield important clues into the pathogenesis of renal disease. The data also indicate the need for enhanced efforts to prevent and treat cardiovascular disease risk factors (such as, diabetes, hypertension, etc.) in this population to reduce the prevalence of renal disease.

ACKNOWLEDGMENTS

This work was made possible by the people who agreed to participate in the Inter-Tribal Heart Project and the local tribal governments. This project was supported by a memorandum of understanding between the Centers for Disease Control and Prevention and the Indian Health Service. Special thanks to Ms. Jan Lovick for helping to prepare the manuscript.

Reprint requests to Bertram L. Kasiske, M.D., Division of Nephrology, Department of Medicine, Hennepin County Medical Center, 701 Park Avenue, Minneapolis, Minnesota 55404, USA.

REFERENCES

1. United States Renal Data System: *USRDS 1996 Annual Data Report*. (Bethesda, MD), The National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, 1997
2. Casper M, Rith-Najarian S, Groft J, Giles W, Donehoo R: Blood pressure, diabetes, and body mass index among Chippewa and Menominee Indians: The Inter-Tribal Heart Project preliminary data. *Public Health Rep* 111(Suppl 2):37–39, 1996
3. Cockcroft DW, Gault MH: Prediction of creatinine clearance from serum creatinine. *Nephron* 16:31–41, 1976
4. Rubin DB, Schenker N: Multiple imputation in health-care databases: An overview and some applications. *Stat Med* 10:585–598, 1991
5. Norusis MJ: *SPSS for Windows: Base System User's Guide; Release 6.0*. Chicago, SPSS Inc., 1993
6. Nelson RG, Bennett PH: Diabetic renal disease in Pima Indians. *Transplant Proc* 21:3913–3915, 1989
7. Kunzelman CL, Knowler WC, Pettitt DJ, Bennett PH: Incidence of proteinuria in Type 2 diabetes mellitus in the Pima Indians. *Kidney Int* 35:681–687, 1989
8. Nelson RG, Newman JM, Knowler WC, Sievers ML, Kunzelman CL, Pettitt DJ, Moffett CD, Teutsch SM, Bennett PH: Incidence of end-stage renal disease in Type 2(non-insulin-dependent) diabetes mellitus in Pima Indians. *Diabetologia* 31:730–736, 1988
9. Kamenetzky SA, Bennett PH, Dippe SE, Miller M, Lecompte PM: A clinical and histologic study of diabetic nephropathy in the Pima Indians. *Diabetes* 23:61–68, 1974
10. Hoy WE, Megill DM, Hughson MD: Epidemic renal disease of unknown etiology in the Zuni Indians. *Am J Kidney Dis* 9:485–496, 1987
11. Hoy WE, Smith SM, Hughson MD, Megill DM: Mesangial proliferative glomerulonephritis in southwestern American Indians. *Transplant Proc* 21:3909–3912, 1989
12. Megill DM, Hoy WE: Risk factors for renal disease in a Native American community. *Transplant Proc* 21:3902–3905, 1989
13. Bianchi S, Bigazzi R, Valtriani C, Chiapponi I, Sgherri G, Baldari G, Natali A, Ferrannini E, Campese VM: Elevated serum insulin levels in patients with essential hypertension and microalbuminuria. *Hypertension* 23(part 1):681–687, 1994
14. Metcalf P, Baker J, Scott A, Wild C, Scragg R, Dryson E: Albuminuria in people at least 40 years old: Effect of obesity, hypertension, and hyperlipidemia. *Clin Chem* 38:1802–1808, 1992
15. Haffner SM, Stern MP, Gruber KK, Hazuda HP, Mitchell BD, Patterson JK: Microalbuminuria: Potential markers for increased cardiovascular risk factors in nondiabetic subject? *Arteriosclerosis* 10:727–731, 1990
16. Kannel WB, Stampfer MJ, Castelli WP, Verter J: The prognostic significance of proteinuria: The Framingham Study. *Am Heart J* 108:1347–1352, 1984

17. The Diabetes Control, Complications (DCCT) Research Group: Effect of intensive therapy on the development and progression of diabetic nephropathy in the Diabetes Control and Complications Trial. *Kidney Int* 47:1703–1720, 1995
18. Klag MJ, Whelton PK, Randall BL, Neaton JD, Brancati FL, Ford CE, Shulman NB, Stamler J: Blood pressure and end-stage renal disease in men. *N Engl J Med* 334:13–18, 1996
19. Fogo A, Breyer JA, Smith MC, Cleveland WH, Agodoa L, Kirk KA, Glassock R, The AASK Pilot Study Investigators: Accuracy of the diagnosis of hypertensive nephrosclerosis in African Americans: A report from the African American Study of Kidney Disease (AASK) Trial. *Kidney Int* 51:244–252, 1997
20. Kasiske BL: Relationship between vascular disease and age-associated changes in the human kidney. *Kidney Int* 31:1153–1159, 1987
21. Kasiske BL, O'Donnell MP, Cowardin W, Keane WF: Lipids and the kidney. *Hypertension* 15:443–450, 1990
22. Kasiske BL, O'Donnell MP, Kim Y, Keane WF: Treatment of hyperlipidemia in chronic progressive renal disease. *Curr Opin Nephrol Hypertens* 2:602–608, 1993
23. Link BG, Phelan JC: Understanding sociodemographic differences in health — The role of fundamental social causes. (editorial) *Am J Public Health* 86:471–473, 1996
24. Blane D: Social determinants of health — Socioeconomic status, social class, and ethnicity. *Am J Public Health* 85:903–905, 1995
25. Robbins DC, Knowler WC, Lee ET, Yeh J, Go OT, Welty T, Fabsitz R, Howard BV: Regional differences in albuminuria among American Indians: An epidemic of renal disease. *Kidney Int* 49:557–563, 1996
26. Pettitt DJ, Saad MF, Bennett PH, Nelson RG, Knowler WC: Familial predisposition to renal disease in two generations of Pima Indians with Type 2 (non-insulin-dependent) diabetes mellitus. *Diabetologia* 33:438–443, 1990